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Japanese Publish d Unexamined (K kai) Patent Application No. S51-129868, published Novemb r 11, 1976; Applicati n N . S50-53904, filed May 7, 1975; Int. Cl.[3]: B01D 53/00 B01J 1/14; Inventor: Masana Itoga; Assignee: Fujitsu Corporation; Japanese Title: Haigasu no Shorihoohoo (Method for Tr atment of Waste Gas)

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1. Title of Invention

Method for Treatment of Waste Gas

2. Claim

A method for treatment of waste gas, characterized in that waste gas containing toxic substances and oxidizing agents are brought into contact with each other in a space wherein plasma is generated; said toxic substances are transformed into stabilized compounds; these compounds are removed from said waste gas.

3. Detailed Description of the Invention

This invention pertains to methods for treatment of waste gas; more specifically, to methods for treatment of waste gas and the like that are used by, for example, a chemical vapor phase epitaxy method and chemical vapor deposition method (CVD), whose methods are used in the semiconductor industries.

Gas used by the CVD method contains toxic substances such as metal hydrides and chlorides. A part of these hydrides and the like reacts with the CVD reaction; layers of metals contained in said hydrides or of oxidized substances thereof and the like are formed on a substrate. The remaining part of hydride gases is exhausted to a point outside the reaction system without reaction. This waste gas cannot be exhausted to the regular exhaust system as they are due to the extreme toxicity.

Methods for absorption of waste gas into various catalysts and the like are well known in order to treat waste gas resulted from the CVD method. However, said methods are complicated; various reactions have to be used according to the types of toxic gases.

Thus, the present invention aims t ff r a method for treatment of waste gas containing toxic substances asily, particularly waste gas resulted from the CVD method.

Said aim is attained by th application of a fact to the treatment of wast gas, which is [illegible] of vapor phase reaction is significantly accelerated at a relatively low temperature of 200°C or less in plasma generated in the reduced pressure system of 10 mmHg.

The method of the present invention is characterized in that waste gas containing toxic substances and oxidizing agents are brought into contact with each other in a space wherein plasma is generated; said toxic substances are transformed into stabilized compounds; these compounds are removed from said waste gas.

This method is described as explained hereinbelow with reference to the drawing.

The drawing is a sectional view of a waste gas treating device 1; current flows in a high frequency coil 4 wound around the central unit. An electrode that generates capacitance inside the device can be used instead of using high frequency coil 4. A vacuum of 0.5 to 10 mmHg is created inside device 1. As a result, plasma 6 is generated inside device 1. The electron temperature of plasma is at about 5 to 20 [illegible] V. (However, the temperature inside the reaction [illegible] is at [illegible] to 100°C.) Waste gas is supplied from inlet 3 of the waste gas treating device; an oxidizing agent is supplied from inlet 2. As for the toxic substance contained in the waste gas, AsH_3, SiH_4, B_2H[illegibel], pH_3, $ABCl_3$, P[illegible]l_3, [illegible]Cl_3, other halogenized metals, various gaseous substances such as HCN, H_2S, or the like, are used. As for the oxidizing agent, oxygen, water, other oxygen containing substances, or substances per se that are reduced by the reaction to said toxic substance, can be used. Because the waste gas and the oxidizing agent are suctioned using rotary pump 5, they pass through a space wherein plasma is generated. The oxidizing agent and waste gas are in contact with each other in this space; for example, the reaction among oxygen, AsH_3, and SiH[illegible] accelerates. As a result, As and Si are

transformed into stabiliz d oxidized substances such as As_2O_3, SiO[ill gibl], and the like. Thes oxidiz d substances are accumulated n the int rnal [illegible] surface of [ill gible] due to the solidification at the reaction temperature. Also, when oxygen and H_2S are reacted with each other, H_2S is transformed into stabilized water and sulfur oxide. Sulfur oxide is exhausted from outlet 7 using rotary pump 5 because it is in a gaseous form at the reaction temperature. Sulfur oxide per se is easily treated. When AsH_3 and SiH_4 are treated or when H_2S is treated, these compounds are transformed into stabilized oxidized substances. Because this oxidizing reaction is performed in plasma, the reaction is effected extremely effectively. The inventor assumes that the oxidizing agent or waste gas that is [illegible] passing through plasma 6 per se does not [illegible] by the plasma; however, he has not reached a definite conclusion yet.

The following effects are obtained according to the present invention:

(1) Due to the effective oxidizing reaction, the amount of waste gas treated per hour increases; also, the concentration of toxic substances that is [illegible] lowers.

(2) Because most toxic substances are [illegible] as the oxidized substance, waste gas is treated more easily. For example, when waste gas containing AsH_3, SiH_4, and H_2S is treated, arsenic and silicon are accumulated as the solid oxidized substance. For said reason, as for toxic substances that transformed into a liquid form or gas form accommodating the reaction temperature and H_2S, gaseous sulfur oxide can be treated by some methods. Therefore, the steps in the process for treatment of the waste gas are significantly reduced.

An embodiment of the present invention is described as explained hereinbelow.

[Embodiment]

Waste gas in the CVD process that contains pH_3, H_2H_3, SiH_4, [illegible], and 1000 to 10000 ppm, is treated. This gas is supplied to [illegible] at the flow rate of 3ℓ/min, as shown in the drawing. Oxygen is similarly supplied at the flow rate of 0.5ℓ/min.; it is also brought into contact with the waste gas. Plasma is

generated by high frequency discharge of 1000 V and 500 kH in a vacuum [illegible] of 1 to 3 mmHg; the mixture gas of [illegibl] and waste gas passes through the plasma. When a part of the gas passed through the plasma is removed and when it is continuously analyzed with an analysis device, no metals are detected; [illegible].

4. Brief Description of the Drawings

The drawing is a sectional view conceptually illustrating the details of [illegible] for application of a method of the present invention.

1...Waste gas treating device

2...Inlet for oxidizing agents

3...Inlet for waste gas

4...High frequency coil

5...Rotary pump

7...Outlet for treated gases

Translations Branch
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